

REMARKS / ARGUMENTS

Reconsideration of the application is requested.

Claims 1, 6-7, 9-10, and 13 are now in the application. Claim 1 has been amended. Claim 13 has been added

In item 3 on page 3 of the above-identified Office action, claims 1, 6-7, and 9-10 have been rejected under 35 U.S.C. § 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

More specifically, the Examiner has stated that the compensation component as shown in Figs. 4-5 has not been disclosed to have a gate insulated from the semiconductor body; the compensation component has not been disclosed to have heavily doped terminal regions disposed at the second main surface; the compensation component has not been disclosed to have a further zone of first activity disposed in a vicinity of the second main surface; and the compensation component has not been disclosed to have punch-through regions disposed between the heavily doped terminal regions.

Claim 1 of the instant application is based on the combination of a CoolMOS with a specific layer thickness of the potential absorbing layer (the space charge zone reaches the second main surface before a field strength in a blocking operation reaches a critical value) and a configuration of a backside with punch-through regions (see Fig. 2). Although the CoolMOS and the backside configuration are depicted in different figures, it is clear from the disclosure that the compensation components are the preferred application area of the invention of the instant application (see, for example, page 23, lines 20-21 and page 24, lines 7-13 of the specification of the instant application). Figs. 4 and 5 only schematically show (see page 21, line 16 of the specification of the instant application) how a compensation component is constructed: the p-conductive columns 24 (see Fig. 4) and 27 (see Fig. 5) are embedded in the n-conductive semiconductor body 20, 21 for charge compensation.

When the compensation principle as explained with the help of Figs. 4 and 5 is applied to the n-channel power MOS field effect transistor (see page 2, lines 11-16 of the specification of the instant application) as described in the disclosure, a person skilled in the art would easily understand that when the invention of the instant application is applied to compensation components as a preferred

embodiment, the compensation regions will be provided in the semiconductor body 1 of Fig. 1 under the p-conductive body zone 4 the same way as in the semiconductor body 1 of Fig. 4 under the p-conductive regions 22, 23.

Therefore, Applicants are of the opinion that the subject matter of claim 1 is clearly supported by the original disclosure. In order to even more clearly show the combination as recited in claim 1, a compensation region 24 has been added to Fig. 1.

It is accordingly believed that the claims meet the requirements of 35 U.S.C. § 112, first paragraph. Should the Examiner find any further objectionable items, counsel would appreciate a telephone call during which the matter may be resolved.

In item 5 on pages 4-7 of the above-mentioned Office action, claims 1 and 9-10 have been rejected as being unpatentable over Park (US Pat. No. 6,051,850) in view of Chen (US Patent Application Publication No. US 2003/0160281 A1) and Nagasu et al. (US Pat. No. 6,204,717 B1) under 35 U.S.C. § 103(a).

In item 6 on page 7 of the above-mentioned Office action, claim 6 has been rejected as being unpatentable over Park,

Chen and Nagasu et al. and further in view of Fruth et al. (US Pat. No. 6,011,280) under 35 U.S.C. § 103(a).

In item 7 on page 8 of the above-mentioned Office action, claim 7 has been rejected as being unpatentable over Park, Chen, Nagasu et al. and Fruth et al. and further in view of Feiler (US Pat. No. 6,236,068 B1) under 35 U.S.C. § 103(a).

The rejections have been noted and claim 1 has been amended in an effort to even more clearly define the invention of the instant application. Support for the changes is found in Figs. 4-5 as well as in newly amended Fig. 1.

Before discussing the prior art in detail, it is believed that a brief review of the invention as claimed, would be helpful.

Claim 1 calls for, inter alia:

a compensation region of said second conductivity type disposed below said body zone in said semiconductor body, said compensation region including columnar, vertically extending compensation areas;

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punch-through regions of said first conductivity type disposed between said heavily doped terminal regions, a current/voltage characteristic in breakdown being controlled through an area ratio between said heavily doped terminal regions and said punch-through regions.

Park shows an IGBT. However, Park does not disclose a compensation area. Also, as opposed to the allegation of the Examiner, Park fails to disclose the punch-through regions that are constructed according to the invention of the instant application (see Fig. 2) and are n-conductive regions which are disposed between the n⁺-conductive zones (9) and abut the backside metallization (11). In contrast, in Park the p⁺-conductive regions 102 and the n⁺-conductive regions alternate under the drain or collector electrode 112.

Chen shows compensation regions 1 in the form of "dumplings," which are embedded as n- or p-conductive regions in an oppositely doped environment and float. In contrast, according to the invention of the instant application, p-conductive columns are provided in an n-conductive environment.

In Nagasu et al. upon the application of a blocking voltage, the space charge zone 28 reaches the junction J2 and releases a punch-through current before an avalanche breakdown appears (see Fig. 10b together with column 15, lines 41-57 and column 16, lines 29-38).

In summary, the prior art discloses neither the compensation columns nor the backside structure as shown in Fig. 2 of the instant application.

It is accordingly believed to be clear that none of the references, whether taken alone or in any combination, either show or suggest the features of claim 1. Claim 1 is, therefore, believed to be patentable over the art and since all of the dependent claims are ultimately dependent on claim 1, they are believed to be patentable as well.

Claim 13 has been added. Since claim 13 is dependent on claim 1, which is believed to be patentable as discussed above, it is believed to be patentable as well.

In view of the foregoing, reconsideration and allowance of claims 1, 6-7, 9-10, and 13 are solicited.

In the event the Examiner should still find any of the claims to be unpatentable, counsel would appreciate a telephone call so that, if possible, patentable language can be worked out.

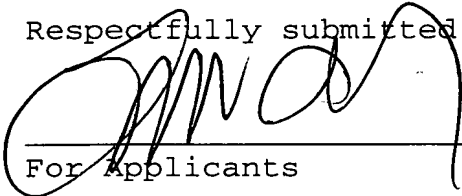
If an extension of time for this paper is required, petition for extension is herewith made. Please charge any fees which might be due with respect to 37 CFR Sections 1.16 and 1.17 to

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1099.

Respectfully submitted,

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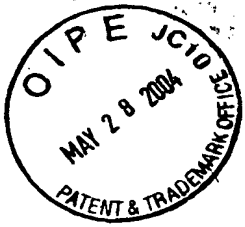


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Annotated Sheet Showing Changes

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Fig. 1

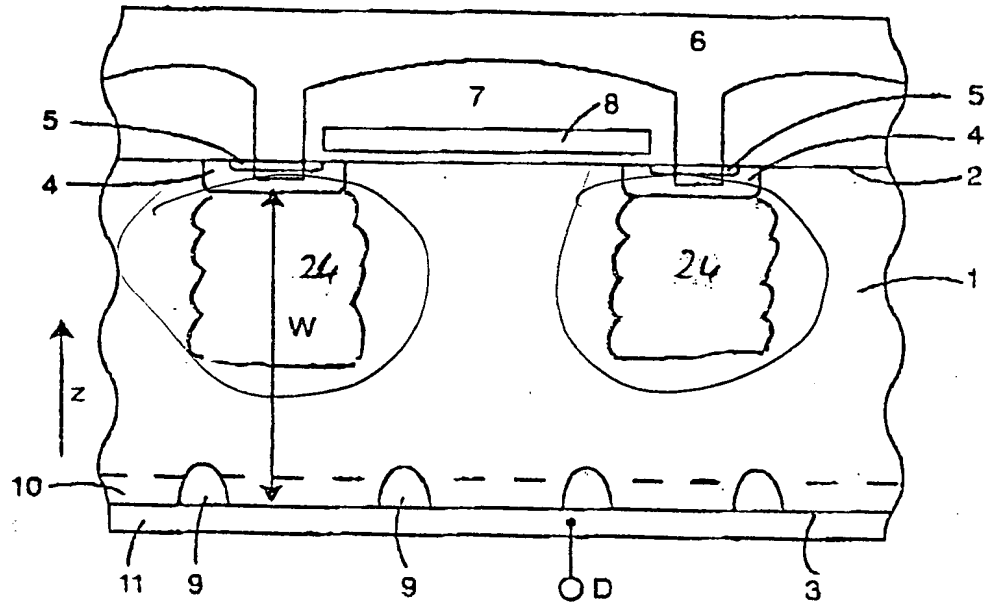


Fig. 2

